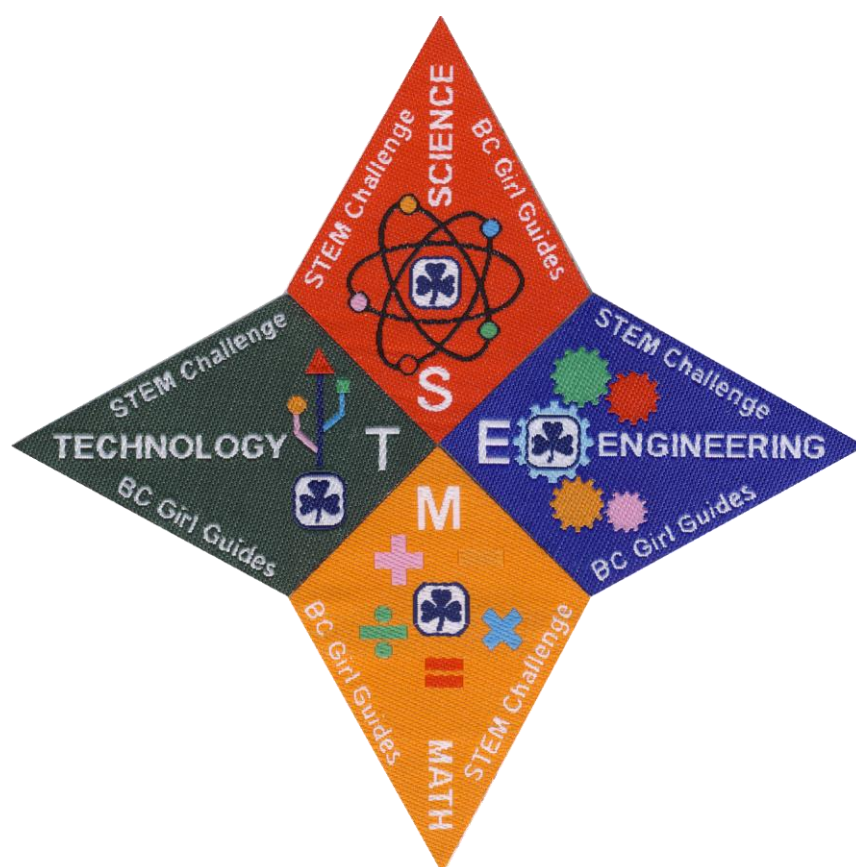


STEM CHALLENGE: TECHNOLOGY

A FOUR-PART STEM CHALLENGE
FROM THE BC PROGRAM COMMITTEE





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INTRODUCTION TO THE STEM CHALLENGE

Welcome to the new, updated Science, Technology, Engineering and Math Challenge from the BC Program Committee. This is a four-part challenge: one booklet, and one ribbon crest, for each of Science, Technology, Engineering and Math. Do just the parts that interest you, or tackle all four and proudly display the complete crest on your camp blanket.

The STEM Challenge is an update of the Science in a Box and Girls Exploring Technology (GET) challenges that were launched by the BC Program Committee several years ago.

As you work on the challenge, please remember: We'd love to hear from you! Please feel free to let us know what activities you've done and what you thought of the STEM Challenge.

Sincerely,

The BC Program Committee

Objectives

To engage girls in technology.

To have fun learning about computers, electronics and modern communication technologies.

Outcomes

At the completion of this challenge, girls will demonstrate an improved awareness of and interest in:

1. computers.
2. electronic devices.
3. modern communication technologies.

What's In the Technology Challenge?

One of the biggest challenges we faced in putting together this new STEM challenge was figuring out what should go into each part. There is a lot of overlap between science and technology, technology and engineering, and engineering and science—and of course, math is fundamental to all the other three. In desperation, we resorted to dictionary definitions to help us out: according to Merriam-Webster, technology is "the practical application of knowledge, especially in a particular area" or "a capability given by the practical application of knowledge". If you've read the Engineering booklet of this STEM challenge, you might notice that this definition is very much like the one Merriam and Webster gave us for engineering. The line between technology and engineering is very fuzzy indeed. So how did we decide what should go into this Technology booklet and what should go into the Engineering booklet?

Our rationale is largely arbitrary. In this Technology booklet, we've decided to focus on those aspects of technology that are commonly referred to as high technology:



"scientific technology involving...sophisticated devices, especially in the fields of electronics and computers" (thanks again to Merriam-Webster for that definition). This part of the challenge therefore contains activities related to computers and other electronics, software, the Internet and modern communications technologies. Although several of these activities necessarily require the use of a computer, we have tried very hard to make it possible for a unit to earn the Technology crest without finding a laptop for everyone in the group. Several activities don't require computers at all; many of those that do can be done individually or in small groups, so girls can do them on a computer at home or school.

Note: A word about safety: if you (or your girls) are doing any of the activities that involve the Internet, make sure you are following the rules about privacy. Make sure parents are aware of and okay with what you're doing, remind the girls never to give out personal information, and be very careful not to publish details of where you are going for meetings, excursions, camps, etc. Remember that nothing on the Internet is ever private!

We hope you enjoy this Technology challenge. And if you're disappointed that it doesn't include space exploration, robotics, medical technology or any of the myriad other "capabilities given by the practical application of knowledge", just step on over to the Engineering booklet once you've finished this part of the STEM challenge!

Challenge Requirements

To earn the ribbon crest for this part of the STEM Challenge, you need to complete activities in order to earn "challenge credits", depending on your branch of Guiding. You can select these activities from this booklet, or you can choose activities from the Internet, books or magazines, other Guiders or people in your community, or any other resources. As long as the activities are challenging for your group and fit the objectives of this part of the STEM Challenge, go ahead and use them. (And if you come across something really cool, please let us know so we can add it to any future STEM-related challenges!)

The "challenge credit" system is new – activities that require more time to complete will earn more credits than the quick activities. The number of challenge credits per activity is listed on the challenge tracking sheet. If you would like to complete an alternate activity, which requires more time and in-depth study, you can use your judgment to determine how many credits the activity should be worth.

The Program Committee has produced a variety of program resources that include STEM activities. Look for additional resources on the [BC Girl Guides website](http://www.bc-girlguides.org/).

	Sparks	Brownies	Guides	Pathfinders	Rangers/ Adults
Total number of credits required.	3	4	5	5	5

When you have fulfilled the requirements, complete the **BC Crests Order Form** found on the BC Girl Guides website <http://www.bc-girlguides.org/> (click on Program > Challenges & Activities > Provincial Challenges). Instructions on how to order the crests are provided on the form.



Program Connections

Each activity in this booklet includes a list of program connections – areas of the girls' regular program that the STEM challenge meets the requirements for. These program connections are intended as guidelines to help you fit the STEM challenge into your regular program planning. In some cases, the challenge activity is very similar to an activity in the program area; in other cases, the challenge activity could be used as an alternative to activities mentioned in the program area. In all cases, remember that the girls' program is intended to be flexible: if an activity meets the objectives of the program area, and if it is interesting and challenging for the girls, by all means give them credit for it as part of their program requirements.

The lists of program connections are also not exhaustive. If you find another program area that is covered by an activity in this booklet, don't hesitate to give the girls credit for it.

You may notice that very few of the activities include explicit program connections for Rangers. The Ranger program encourages in-depth exploration of topics of interest. Many of the activities in this booklet, on the other hand, are relatively short and simple — so that busy Guiders can easily incorporate them into unit meetings — and offer only a very superficial taste of the subject matter. That makes it difficult to draw direct connections between these activities and the Ranger program. However, because the Ranger program is also very flexible and self-directed, Rangers can certainly take any of these activities and expand or combine them to meet the objectives of one of the program areas. Rangers who are working in units can also plan and lead any of these activities for younger girls.

**STEM CHALLENGE: TECHNOLOGY TRACKING SHEET**

Sparks	Brownies	Guides	Pathfinders	Rangers/ Adults
3	4	5	5	5

Except where indicated, activities in this challenge are worth 1 credit each.

- | | |
|---|--|
| <input type="checkbox"/> Cyber-Safety: CyberSense Poem (S,B) | <input type="checkbox"/> E-Cycling |
| <input type="checkbox"/> Cyber-Safety: Jo Cool & Jo Fool (G, P) | <input type="checkbox"/> Hard Drive Maintenance (2 credits) |
| <input type="checkbox"/> Cyber-Safety: In the Eye of the Beholder (P,R) | <input type="checkbox"/> Fibre-Optic Water |
| <input type="checkbox"/> Social Media Awareness (G, P, R) | <input type="checkbox"/> Logical Obstacle Course |
| <input type="checkbox"/> Be a Computer! | <input type="checkbox"/> Computer Programming |
| <input type="checkbox"/> Build a Computer (S, B) | <input type="checkbox"/> Write a Program from Scratch (2 credits) |
| <input type="checkbox"/> Computer Jeopardy | <input type="checkbox"/> Robot Pin the Tail on the Donkey |
| <input type="checkbox"/> Computer Parts Word Search | <input type="checkbox"/> Training your Robot |
| <input type="checkbox"/> Mixed Up Tech Words Puzzle | <input type="checkbox"/> Robbie the Robot |
| <input type="checkbox"/> Squeaky Clean | <input type="checkbox"/> Global Positioning System (1 credit if you do just the activities in this booklet, 2 credits if you also go geocaching) |
| <input type="checkbox"/> Computer Concentration | <input type="checkbox"/> Pixel Picture |
| <input type="checkbox"/> Cell Phone Relay | <input type="checkbox"/> Internet Packet Relay |
| <input type="checkbox"/> Dissect a Cell Phone | |
| <input type="checkbox"/> String Phones | |

Other Technology Activities

Alternate activities that meet the objective of this challenge.

- | | |
|--------------------------------|--------------------------------|
| <input type="checkbox"/> _____ | <input type="checkbox"/> _____ |
| <input type="checkbox"/> _____ | <input type="checkbox"/> _____ |
| <input type="checkbox"/> _____ | <input type="checkbox"/> _____ |



ACTIVITIES

Cyber-Safety: CyberSense Poem

This activity is from the CyberCitizen challenge (<http://www.girlguides.ca> select Programs > Specialized Programming > Cybercitizen Challenge) and will complete 1 of 2 activities required for Sparks or Brownies to earn that challenge. It focuses on learning the difference between general and personal information and why protecting your private information on the Internet is important. Reinforce the lessons learned by sending home a copy of the CyberSense Poem home and ask the girls to memorize it for the next meeting.

Directions

1. Tell the girls, "Today we are going to be looking at the difference between personal information and general information. Personal information tells people who you are and where you live; general information tells people about things you like or do, but not who you are."
2. Place the two sheets of paper with "General information" and "Personal information" on the floor. Read each cue card out loud, one at a time, and have the girls decide which category the information falls under and then place the card on the floor beside the appropriate category. (The test question for each one is: would this information tell someone that you are Jenny Smith and how they can contact you?)
3. Explain to the girls that protecting your personal information is very important when you are on the Internet because you don't always know who you are talking to or who can see the information you post. The most important message for them to understand is to get help from an adult before posting any information online or communicating with others online.
4. To help reinforce what they've learned, have the girls memorize and bring home copies of the CyberSense Poem.

Supplies

- ☐ copy of CyberSense poem for each girl
<http://mediasmarts.ca/tipsheet/cyber-sense-poem>
- ☐ prepared cue cards for each girl: "my real name," "my age," "where I live," "my favourite colour," "my email address," "my school name," "my favourite animal," "my favorite game," "my favourite food," "my phone number."
- ☐ 2 signs – General Information & Personal Information

Program Connections

Sparks: Exploring and Experimenting Keeper
Brownies: Key to STEM; Information Technology is "IT" interest badge



Cyber-Safety: Jo Cool and Jo Fool

This activity is from the CyberCitizen challenge (<http://www.girlguides.ca> select Programs > Specialized Programming > Cybercitizen Challenge) and will complete 1 of 2 activities required for Guides or Pathfinders to earn that challenge. During this Cyber Tour, the girls will travel through a variety of websites with Josie and Joseph Cool. At each site, the girls will use a series of questions to decide whether Jo and Jo are making the right or wrong decision about whether to use the site. These situations can be used as springboards for discussion and critical thinking about responsible internet use.

The *Cyber Tour* is followed by a 20-question multiple-choice *Cyber Quiz* that reinforces the lessons that have been learned. Completion of the Cyber Tour and Cyber Quiz will complete the CyberCitizen Challenge.

Directions

1. Have each girl write “Cool” and “Fool” on each side of her cue card and then glue her card to a Popsicle stick. (They will be using these to indicate their answers.)
2. Gather the girls around a computer (or in front of a screen if you are using an overhead projector). Have each girl have their voting sticks ready.
3. Take the girls through each of the twelve scenarios on the website <http://mediasmarts.ca/game/jo-cool-or-jo-fool-grades-6-8>. At the prompt at the end of each scenario – What kind of web site is this? What decision does Jo have to make? What should Jo look out for? Does Jo make the right decision? Discuss the answers as a group and then have girls vote, using their sticks, for “Fool” or “Cool.”
4. To complete their challenge badge, girls must complete the accompanying cyberquiz for this game. This can be done either at the meeting, if time permits and there are extra computers available, or at home. Girls must submit a printout of their final score to their leader (which should be at least 12 out of 20) in order to complete the challenge badge.

Supplies

- ☐ Internet connected computer(s)
- ☐ review the PDF document from the Cybercitizen challenge: https://www.girlguides.ca/uploads/File/opportunities_for_girls/challenges_and_activities/cybercitizen_challenge/2012/G-P-jo-cool-jo-fool-all-issues.pdf
- ☐ popsicle sticks (one per girl), markers, cue cards (one per girl) and tape or glue

Program Connections

Guides: Computer Skills badge
Pathfinders: Web Surfin' module



Cyber-Safety: In the Eye of the Beholder

This activity is from the CyberCitizen challenge (<http://www.girlguides.ca> select Programs > Specialized Programming > Cybercitizen Challenge) and will complete 1 of 2 activities required for Pathfinders or Rangers to earn that challenge. In this activity girls use a self-questionnaire and guided discussion to reflect on how their Internet activities may leave them vulnerable to online risks.

Directions

Distribute the “A Few Questions...” handouts and ask the girls to answer them by circling the answer they most agree with. Explain that they will not have to share their answers to the third question unless they wish to.

Supplies

- ☐ Internet connected computer(s)
- ☐ PDF document from Cybercitizen challenge: http://www.girlguides.ca/uploads/File/opportunities_for_girls/challenges_and_activities/cybercitizen_challenge/2012/P-R-eye-of-the-beholder-safety.pdf
- ☐ copies of the handout “A Few Questions” – from the PDF documentation
- ☐ “Facts” Cards copied onto cardstock and cut out. – write the number of the question on the back. – from the PDF documentation

Program Connections

Pathfinders: Web Surfin' module

Rangers: Community Connections (Social Aggression and Bullying; Community Challenges; Changing Communities); Global Awareness (The World on Your TV)



Social Media Awareness

This activity allows the girls to demonstrate what they know about different types of social media.

Directions

1. Divide the girls up into small groups of 3-4.
2. Give each group a cue card with a social media word on it.
3. The group is supposed to create a mini-skits and act out two scenarios showing how that social media is used in everyday life. One scenario should show inappropriate use of that social media and the other scenario shows appropriate use of the social media.
4. After each skit have the girls discuss the social media and the content covered in the skit.

Supplies

- ☐ cards with words like Instagram, Facebook, Twitter, Pinterest, Tumblr, etc.

Program Connections

Guides: Computer Skills badge
Pathfinders: Web Surfin' module
Rangers: Community Connections (Social Aggression and Bullying; Community Challenges; Changing Communities); Global Awareness (The World on Your TV)



Be a Computer!

Draw a computer and look at the components of a computer. Use the girls to simulate a mouse, IO controller and a processor on the example of Calculator program. Before simulating the whole system, let the girls get a feel of each individual component

Directions

Before the activity, draw a calculator on the large paper. Draw large numbers from 0 to 9, “+”, “-” and “=” on coloured paper.

Players should have something that identifies them as their computer part:

- Mouse: hardhat or helmet (when users “click” on it)
 - Processor: big nerd glasses
 - Monitor (output controller): mouse pointer (arrow) made from cardboard.
1. Draw a computer on a large piece of paper or poster board with the felt pens. Make sure that you include the computer box, monitor, keyboard and mouse. Talk about the name of the components as you draw them and what part they play in a working computer.
 - **Box** – contains the CPU (Central Processing Unit) or the “brain” of the computer. This is the most important piece of the computer as it is what makes everything work.
 - **Monitor** – this is the “face” of the computer. It lets us see what’s going on.
 - **Mouse** – helps us move from place to place on the screen
 - **Keyboard** – has letters, numbers and symbols. We type on the keyboard to put information into the computer
 2. Bring out your pre-drawn picture of a calculator:
 - Explain that on the keyboard there is a calculator. This allows us to put equations into the computer. Get the girls to cut out the pre-drawn numbers 0 to 9, “+”, “-”, and “=”.
 - Talk about what a calculator does. As you are talking, place the numbers and symbols on the top bar to show how an equation is displayed.
 - Use a real calculator to demonstrate how quickly a computer can calculate the answer. Some of the girls may wish to race the calculator. If this is the case, start with simple equations, e.g. $1+2 =$, $2+3 =$ etc., working up to more difficult ones.
 3. Mouse:
 - You will need two girls. One will be the mouse; the other will be the user. The mouse wears a hardhat or helmet, which is the “clicker”.
 - The user will operate the mouse by gently holding her on either side of the waist and maneuvering her in the direction that she needs to go. Remind the girls that

Supplies

- ☐ large piece of paper or poster board
- ☐ felt pens
- ☐ scissors
- ☐ coloured paper
- ☐ scotch tape
- ☐ mouse pointer made from cardboard
- ☐ crayons
- ☐ digits 0-9 and +, -, = cut out of coloured paper
- ☐ calculator
- ☐ helmet or hardhat
- ☐ big nerd glasses



they can't push or shove the mouse. She can be move "up" (forward), "down", (backward), "left", and "right" or press the top of the helmet to "click" her mouse.

- The girls can participate by yelling directions for the user to do.

4. Monitor:

- Use a large piece of paper to draw a monitor. You could also use a large chalkboard or whiteboard. On the monitor, draw a calculator with the numbers and symbols in place or add your pre-drawn calculator to the middle of the monitor.
- Assign one girl to be the mouse pointer. When the girls direct the mouse, the girl with the pointer moves it according to the instructions as well, e.g. the mouse moves right – the pointer moves right.
- Decide on a certain number, and ask the girls to direct the mouse and pointer to the number.

5. Piecing it together: Girls are assigned the following roles:

- **Mouse user** – moves and clicks the mouse.
- **Mouse** – follows the direction of the user.
- **Mouse controller** – a single girl or group that gives directions to the mouse by yelling "up", "down", "left", "right" or "click".
- **Mouse Pointer** – moves the pointer on the computer monitor
- **Memory** – records the equation and gives it to the CPU for the computer.
- **CPU** (Central Processing Unit) – runs the program to determine the answer to the equation. When it knows the answer, it passes it to the display for recording.
- **Display** – records the answer on the monitor.
- **Antivirus** – hide virus symbols around the area and have antivirus girls looking for them while the program is running. If they find them, they bring them back to the processor who destroys them.

Once the girls all know their roles, have them act out how a computer works.

Sample Scenario

1. Before you begin, have the **Memory**, **CPU** and **Display** sitting facing away from the monitor. They are not to see what is happening on the monitor.
2. Give the **Mouse Controller** an equation (written on a piece of paper) for the computer to calculate. For example, $5 + 10$. Nobody except for the **Mouse Controller** should know what the equation is, so don't say it out loud!
3. The **Mouse Controller** then calls out directions for the **Mouse User**.
4. The **Mouse User** moves the **Mouse**, and the **Mouse Pointer** watches carefully and moves the pointer on the monitor to match the movements of the **Mouse**. When the **Mouse** stops moving, the **Mouse Pointer** stops moving, as well.
5. When the **Mouse Controller** calls out for the **Mouse User** to "click" the **Mouse**, the **Memory** looks at the monitor, then writes down the number or symbol that is under the pointer at that time. So, if the pointer is on pointing at the 5, the **Memory** writes down a 5 on a piece of paper. She does not show it to anyone else, nor does she call out what she has written down. As soon as she has written down the number or symbol, she again faces away from the monitor. She can only look at it when the mouse has been clicked.



6. Continue until the **Mouse** is clicked when the pointer is on the equals = sign.
7. The **Memory** then (silently) passes the equation (written on paper) to the **CPU**.
8. The **CPU** calculates the equation (if it is a difficult equation, give the **CPU** a real calculator to help – we are not testing math skills here!).
9. When the **CPU** has the answer to the equation, she writes it on a piece of paper, and (silently) passes the paper to the **Display**.
10. When the **Display** receives the answer to the equation, she gets up and writes the answer on the monitor (in the appropriate spot on the pre-drawn calculator).
11. Keep a few girls busy by having them search for “viruses” (pieces of paper with the word “virus” on them – or with a funny looking virus image) in the room. Bring the viruses to the **CPU**, who can destroy them however she would like – tear them up, crumple them into a ball, etc.

Program Connections

Sparks:	Exploring and Experimenting Keeper
Brownies:	Key to STEM; Key to the Arts
Guides:	Computer Skills badge
Pathfinders:	Computer Whiz module



Build a Computer (for Junior Techies)

This activity can help younger girls learn about the parts of a computer while allowing them to express their creativity. To see examples of other computer creations, search online: <https://www.google.ca/#q=cardboard+computer&tbm=isch> or <https://www.google.ca/#q=cardboard+computer+kids&tbm=isch>. This activity is intended for Sparks and Brownies only.

Directions

1. Lay all of the crafting materials out on a table.
2. Before building computers, discuss with girls the type of computers they have at home. Chances are that most of them have desktops, but won't know what it's called. Some will have laptops or tablets. Discuss some of the computer parts and what they do.
3. Ask the girls to use the craft supplies to build their own computer. They can either work on their own or in small groups. Let them be as creative as they like. You may wish to have a picture of a keyboard so they can see the order of the letters and numbers.
4. When everyone has finished, have some time for show and tell.

Supplies

- ☐ boxes of varying sizes from small to large (make sure that some are flat like pizza boxes as some girls may choose to build a laptop)
- ☐ cardboard
- ☐ scrap cardstock in varying colours
- ☐ alphabet and number stickers
- ☐ program icons for the desktop/screen (e.g. games, calculator, browsers, Microsoft Word, etc.)
- ☐ masking tape
- ☐ duct tape
- ☐ yarn or string
- ☐ glue
- ☐ markers or pencil crayons
- ☐ scissors

Program Connections

Sparks: Exploring and Experimenting Keeper
Brownies: Key to STEM; Super Crafts interest badge



Computer Jeopardy

This activity uses a Jeopardy-like game format to reinforce the girls' knowledge of the basic parts of a computer. No computers required for this game!

Note: This game assumes the girls already have some basic experience with computers. If this is not a valid assumption for your group, you might want to plan a session beforehand to learn about the parts of a computer (perhaps with a guest speaker), then use this game as a fun way to review what the girls have learned.

You will need to create the questions for this game ahead of time. Use the questions in the tables below, or create your own. Write each question on one side of a sheet of paper (cardstock or construction paper work well); on the other side, write the point value of the question. Add an extra sheet for each category name. Don't put the answers on the sheets; keep them separate for reference when you are playing the game.

The standard Jeopardy game has 25 questions, five in each of five categories. You can use more or fewer questions or categories as needed to fit the time available.

Directions

1. Tape the question sheets, question side down, onto a wall or similar surface at your meeting location. Arrange them by category and point value as in the table above. Alternatively, use file folders and place them on the ground in five rows of fives. Write the points on the file folder and place the question sheet inside the file folders.
2. Divide the group into two equal teams. Give each team a buzzer or other noisemaker, or ask them to choose a noise they will make when they have figured out the answer to a question.
3. Flip a coin to see which team goes first. That team picks a category and point value (e.g., "Abbreviations for 500").
4. Turn over the chosen paper, read the question, and start the timer. Both teams try to figure out the answer to the question; when they have it, they sound their buzzer/noisemaker.
 - The first team to buzz gives their answer. In TV Jeopardy, answers must be in the form of a question (e.g., "What is a Liquid Crystal Display?"). It is up to you if you want to enforce this rule or not.
 - If the first team gives the correct answer, they win the point value of the question. If they answer incorrectly, the other team gets a chance to answer and win the point value of the question. Keep a running tally of each team's score.
 - The team that answers correctly gets to pick the next question.
 - If neither team answers correctly, nobody gets the points, and the team that picked the question gets to pick the again.
5. The team with the most points when all the questions have been answered wins.

Supplies

- ☐ question sheets
- ☐ tape
- ☐ stopwatch or egg timer
- ☐ two buzzers, bells or other noisemakers
- ☐ extra paper and pen for keeping score

**What else you can do with this**

This activity can be easily adapted for younger girls, or girls who have little experience with computers, by using fewer questions and selecting questions that fit with the girls' level of knowledge. Another option for younger girls is to phrase the questions in a multiple choice format where they are given the answer in the selection.

Computer Jeopardy Questions**Category: Input Devices (Things We Use to Put Information Into a Computer)**

Point Value	Question (Answer)
100	You can use this input device to point and click. (A: mouse)
200	This input device can be connected to a computer to download photos you have taken. (A: digital camera; smartphone, tablet)
300	Use this input device to record sounds, like your voice reading a story. (A: microphone)
400	This input device is used mostly for playing computer games. (A: joystick)
500	Use this input device to create an image of a paper document and save it on your computer. (A: scanner; photocopier)

Category: Output Devices (Things We Use to Get Information Out of a Computer)

Point Value	Question (Answer)
100	This output device looks kind of like a TV screen. (A: monitor)
200	You might use this output device to listen to music. (A: speakers; earphones)
300	You can use this output device to create a paper copy of your work. (A: printer; photocopier)
400	A shiny circular output device that you can burn movies or music onto. (A: CD or DVD)
500	You might connect your computer to one of these to show a movie on a screen or white wall. (A: digital projector)

**Category: Computer Hardware (Components of a Computer System)**

Point Value	Question (Answer)
100	This type of computer is small and lightweight, designed to be portable. (A: laptop; tablet; smartphone)
200	This component is used for reading data from a CD. (A: CD-ROM drive)
300	This component sends information from a computer over a telephone line. (A: modem)
400	Often referred to as the computer's "brain", this component performs most of the computer's functions. (A: central processing unit, or CPU)
500	This type of connector, often used on printers, cameras and memory sticks, makes it easy to plug external devices into your computer. (A: USB, or Universal Serial Bus)

Category: Computer Software (Programs that Run on a Computer)

Point Value	Question (Answer)
100	If you wanted to write a story for your English class, you could use this kind of program. (A: word processing program; e.g., Microsoft Word)
200	This kind of program is handy for sending electronic letters to your friends. (A: email; text message on a smartphone; e.g., Microsoft Outlook, Mac Mail)
300	If you wanted to surf the Internet, you could use this kind of program. (A: web browser; e.g. Internet Explorer, Firefox, Safari)
400	This kind of program is very useful if you have a lot of data that you need to do calculations on. (A: spreadsheet program; e.g., Microsoft Excel)
500	If you have a lot of information that you need to keep track of, you might want to use this kind of program. (A: database program; e.g., Microsoft Access, Filemaker Pro)

**Category: Computer Abbreviations**

Point Value	Question (Answer)
100	CD (A: Compact Disc)
200	PC (A: Personal Computer)
300	DVD (A: Digital Versatile Disk or Digital Video Disk – this is the old term)
400	ROM (A: Read-Only Memory)
500	LCD (A: Liquid Crystal Display)

Program Connections

Sparks: Exploring and Experimenting Keeper
Brownies: Key to STEM
Guides: Computer Skills badge
Pathfinders: Computer Whiz module
Rangers: Community Connections (Changing Communities)



Computer Parts Word Search

J	R	S	U	J	M	H	K	U	R	D	M	O	S	R
C	V	G	Z	C	F	K	H	P	R	E	P	Y	P	O
M	D	I	O	W	U	I	E	A	W	F	I	L	E	M
D	I	Z	R	H	M	H	O	Y	E	L	H	P	A	J
F	G	S	H	O	M	B	J	Y	B	A	C	P	K	G
H	A	R	D	D	R	I	V	E	R	O	R	U	E	K
X	R	E	C	E	M	Z	G	D	D	P	A	S	R	R
D	M	O	H	K	W	W	W	F	B	M	U	R	S	E
Y	V	T	T	E	R	A	W	T	F	O	S	E	D	T
R	O	Q	O	I	R	M	W	J	M	U	P	W	R	N
M	H	T	S	E	N	K	E	X	M	S	E	O	P	I
C	P	U	Y	T	H	O	S	M	R	E	P	P	Q	R
S	C	A	N	N	E	R	M	I	O	A	Z	E	M	P
E	L	B	A	C	U	K	M	D	D	R	M	K	F	K
P	Q	Y	E	T	D	S	G	S	Y	N	Y	K	S	P

CABLE

CHIP

CPU

DISK

HARD-DRIVE

HARDWARE

KEYBOARD

MEMORY

MODEM

MONITOR

MOTHERBOARD

MOUSE

PORT

POWER-SUPPLY

PRINTER

RAM

ROM

SCANNER

SOFTWARE

SPEAKERS



Mixed Up Tech Words Puzzle

SCRAMBLED WORDS	ANSWERS
1. TRUMPECO	
2. RHESCREA	
3. SONCLERITEC	
4. HWEARDRA	
5. OAMINTONCIMCU	
6. GETAGSD	
7. LELC HNOEP	
8. ADDOWLON	
9. SEECCNI	
10. NMHIEAC	
11. GEYERN	
12. RCUIITC	
13. NASSIROTTR	
14. BATRETY	
15. RFUETU	
16. ITNVOOINAN	
17. TEUODACIN	
18. LDC	
19. HICPERNOMO	
20. CTIIRCU ARODB	

Answer key:

1. computer; 2. research; 3. electronics; 4. hardware; 5. communication; 6. gadgets; 7. Cell phone; 8. Download; 9. Science;
10. Machine; 11. Energy; 12. Circuit; 13. Transistor; 14. Battery; 15. Future; 16. Innovation; 17. Education; 18. LCD; 19. Microphone;
20. Circuit board



Squeaky Clean

Cleaning your computer is an important part of keeping it in good working condition. Otherwise, accumulated dust and dirt can damage components or cause the computer to overheat.

Note: When cleaning your computer, make sure you keep liquids well away from it. Put liquids onto a cloth or cotton swab, then use the cloth or cotton swab to wipe the computer—DON'T spray liquids directly onto the computer.

Although cleaning the inside of the case is important, we don't recommend you open up the case of the computer to clean inside it, unless you know what you are doing or have a knowledgeable person helping you. If you touch something inside the computer you could give it a static shock, which can damage components or cause data to be lost.

If the user manual for your computer provides any guidelines or instructions for cleaning the computer, follow them.

Directions

1. Turn off the computer and unplug all the cords. You might want to make a note of where everything is connected, so that you can put it back together again when you are finished.
2. Gently wipe away any dust that has gathered on top of the computer case and in the vents or cooling fan.
3. Dip a cotton swab in the rubbing alcohol so that it is damp; if it is very wet, give it a little squeeze to remove the excess rubbing alcohol. Carefully wipe it around all the openings on the back of the computer case. Go around them all again with a dry cotton swab.

CAUTION: Rubbing alcohol is poisonous. Don't drink it, and don't leave it where pets or small children might get into it.

4. Turn the keyboard upside down and gently shake out any crumbs, dirt and accumulated dust.
5. Using a can of compressed air or your lungs, blow all around the keys to remove any additional dust. If you have a small brush, use it to gently sweep dust away from the keys.
6. Dip a clean, lint-free cloth in rubbing alcohol and wring it so that it is only slightly damp. Wipe the outside of the mouse clean.
7. If you have a mechanical mouse (the kind with the ball inside) open it up by turning the plastic ring on the bottom counter-clockwise. Take out the ball and wash it in warm soapy water. You might need to use your fingernail to scrape off any really stubborn gunk. Dry the ball thoroughly.

Supplies

- ☐ a PC in need of cleaning
- ☐ clean, lint-free cloths
- ☐ rubbing alcohol
- ☐ cotton swabs (such as Q-tips; don't use cotton balls)
- ☐ can of compressed air (available from electronics shops or family department stores)
- ☐ small brush
- ☐ warm soapy water
- ☐ spray bottle of clear water



8. Moisten a cotton swab with clear water and clean the rollers inside the mouse. Dry all the parts of the mouse thoroughly and put it back together.
9. To clean the monitor, gently wipe off any dust that has accumulated on the top and sides of the monitor. Gently wipe the screen with a clean, soft, dry lint-free cloth.

Note: Don't use any alcohol or ammonia-based cleaners on the screen, unless your owner's manual specifically says it is okay to do so.

Note: Don't use paper towels or coarse cloths to clean the screen—you could scratch it.

Note: LCD screens (flat-screen monitors/TVs, laptop screens) are very sensitive. Be very gentle when cleaning these screens. If a dry cloth doesn't get all the grime off, look for special LCD cleaning solutions at your local computer shop.

10. When all the components are completely dry, plug everything back in the way it was when you started.

Program Connections

Brownies: Key to Active Living; Information Technology is "IT" interest badge
Guides: Computer Skills badge
Pathfinders: Exploring a Theme (Computer Whiz)
Rangers: Community Connections (Changing Communities)



Computer Concentration

Learn about computer parts by playing this game of cards.

Preparation

1. For Sparks, print 2 copies of the cards and play with just the picture cards. For all other ages, print 1 copy of the cards on cardstock for each group.
2. With Brownies, play with the picture and the word cards – leave the definition out of play. With older girls, use the picture and definition cards. Cut them apart, shuffle and lay the cards out face down on a table or floor in front of the group.

Supplies

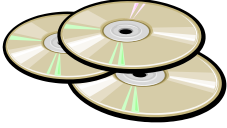

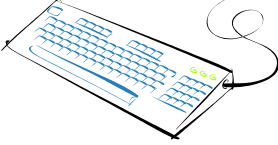



- ☐ computer concentration cards (included)

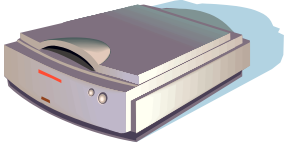


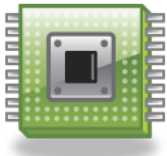

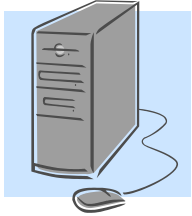
Directions

1. Play like the concentration card game with the first person picking 2 cards. If the picture matches the definition, she can keep the cards and pick again. If they don't match, she turns the cards back over and then play moves to the next person.
2. Continue playing until all matches have been made.

Program Connections

- Sparks:** Exploring and Experimenting Keeper
Brownies: Key to STEM
Guides: Computer Skills badge
Pathfinders: Computer Whiz module
Rangers: Community Connections (Changing Communities)

	<p>A round object that holds information for or from your computer.</p>	<p>CD</p>
	<p>A machine that you can insert a CD or DVD into.</p>	<p>DISK DRIVE</p>
	<p>A board that is used for typing. It has numbers and letters on it.</p>	<p>KEYBOARD</p>
	<p>The screen that lets you see what you are entering when you're on your computer.</p>	<p>MONITOR</p>
	<p>A plastic object that has a ball on the bottom and one or two buttons on the top. When you click on it, you usually click on the left button.</p>	<p>MOUSE</p>
	<p>A machine that transfers things from the computer onto paper using ink.</p>	<p>PRINTER</p>

	<p>A piece of equipment that copies pictures so that you can use it in your computer projects.</p>	<p>SCANNER</p>
	<p>The part of the computer that projects the sound from the computer.</p>	<p>SPEAKERS</p>
	<p>The part of the computer that connects to the phone lines so that you can go on the Internet.</p>	<p>MODEM</p>
	<p>A small piece inside the computer that helps your computer work. These have to be programmed by people or they won't work.</p>	<p>COMPUTER CHIP</p>
	<p>The main board in the computer that has many chips on it. It makes the computer work. It is also is where the memory and the processing are found.</p>	<p>MOTHER-BOARD</p>
	<p>The brain of the computer. Like a brain, it controls information and tells other parts what to do.</p>	<p>CPU (CENTRAL PROCESSING UNIT)</p>



Cell Phone Relay

This game models a cellular phone network. Several people who are making phone calls move around an area, and as they go, their phone calls are passed from one cellular tower to another. How many people can be talking at the same time before calls start getting dropped?

This game is best for larger groups, but it will work with smaller groups as well.

In this game, everything is a model for a something in a real cell phone network:

- Girls who are Talkers represent people talking on cell phones. Just like in real life, the Talkers move around while they are on the phone. The cellular network has to keep track of which phone call is coming from which Talker and where the Talkers are.
- Each Talker is assigned a baton (which travels from tower to tower) and a matching flag. This makes it easier to match the phone with the person using it.
- Girls who are Towers represent a network of cell phone towers. These are used to transmit the phone call over radio waves. Each tower can only transmit over a small area. For this game, that area is represented by the arms' reach of the Tower girls. As the girl talking on her cell phone walks around, her phone call baton is passed, from tower to tower. The tricky part of designing a cell phone network is making sure that the towers are close enough and there are enough of them so the person talking on the phone won't have her call dropped.

The goal of any cellular network is to drop as few calls as possible. How many of the calls on your network are dropped? How does this compare to the number of people talking?

Directions

1. Divide the girls up into two teams, "Towers" and "Talkers". You might want to start with a lot of Towers and only a couple of Talkers until everyone gets the hang of how to play. Once they do, add more Talkers to make the game more fun and challenging.
2. Arrange the Towers in a rows so that each Tower can just reach her neighbour (without bending) when they both have their arms outstretched. This is the Tower grid.
3. Give each Talker a baton and a matching flag. She needs to attach the flag to herself so it is clearly visible and hold the baton in her hand. Talkers take their place all around the outside of the Tower grid..
4. On the word "Go!", each Talker hands her baton to the nearest Tower, and starts walking through the Tower grid. As she walks, the Towers must keep her baton at the tower closest to her by passing it to the next Tower.
 - Each Tower can only hold two batons at a time. If she already has two and a third one is passed to her, she must drop one of the batons.

Supplies

- ☐ batons, ribbons or bean bags in different colours
- ☐ flags, shirts, ribbons or scarves to match the batons



- If a Talker gets to her destination but her baton doesn't arrive at the same time, it means the cellular network "dropped" her call. The goal is to drop as few calls as possible.

What else you can do with this

The simplest way to play is to have each Talker walk straight through the Tower grid to the other side. To add complexity, you could require each talker to go all the way through and then back, visit each corner of the grid in turn, make a designated number of turns inside the grid or stand still now and then.

As the girls get the hang of the game, you can increase the challenge (and the fun) by adding more Talkers, or by suddenly removing a Tower from somewhere in the grid (representing a cell tower that suddenly fails). Can the "failing" tower switch the calls she is carrying to another Tower without dropping any?

Program Connections

Sparks:	Exploring and Experimenting Keeper
Brownies:	Key to STEM; Key to Active Living; Communications is Where it's @ interest badge
Guides:	Engineering badge
Pathfinders:	Everything Comes from STEM module



Dissect a Cell Phone

Ever wondered what's inside a cell phone? If you have an old one hanging around, try taking it apart!

Note: Make sure the cell phone you are planning to take apart is an old one that nobody wants to use. It's theoretically possible to put it back together again, but let's not take the chance.

The instructions given here are very generic. Cell phones vary greatly in their design; some come apart very easily and others need considerable coaxing. Once you've got it open, you'll also find a lot of variation in the number, type and arrangement of the internal components. These instructions are intended to get you started, and if you want more information, try looking on the Internet. If you type "what's inside a cell phone" or "take cell phone apart" into a search engine, you'll get all sorts of information. You might even be able to find details on your particular brand and model of cell phone.

Directions

1. Make sure the cell phone is really unwanted. Don't just assume that your older brother never plans to use his cell phone again.
2. Turn the cell phone off and remove the battery. The battery compartment is usually at the back of the phone, under a cover that can be slid off or lifted up without removing any screws.
3. You will probably find the phone's SIM card underneath the battery (you might need to peel off a label to find it). It's shiny and gold-coloured, usually.

Note: SIM stands for Subscriber Identity Module. The SIM card stores a special key code that uniquely identifies the cell phone user.

4. Use a small screwdriver to remove the screws holding the cell phone together. At this point, you should be able to take the whole phone apart; you may need to do some prying. See how many of these components you can identify:
 - Printed Circuit Board
 - Microphone
 - Antenna
 - Speaker
 - LCD (Liquid Crystal Display) screen
 - Keyboard
 - Camera
5. When you have finished investigating your phone, see if you can put it back together, then wash your hands with soap and water. Recycle the remains of the phone (see *E-cycling*).

Supplies

The tools you use will vary greatly depending on the type of cell phone you are dissecting. As a general idea, though, you'll need:

- ☐ old, unwanted cell phone
- ☐ small jeweler's screwdriver, of the type that will fit into the screws holding your cell phone together
- ☐ thin, strong prying device, like a guitar plectrum or credit card
- ☐ computer with an Internet connection (optional, but handy for finding information about what's inside your cell phone)



What's Inside a Cell Phone

Printed Circuit Board (PCB): This is usually green, sometimes black. The brains of the phone, the PCB carries a large number of electronic devices: small, flat black packages, often with lots of silver legs called pins sticking out from them (although some have the pins hidden underneath). Can you see little gold lines crisscrossing the PCB? Those are tiny wires connecting the electronics together.

What are some of the electronics on the printed circuit board? Most of the electronics will have part numbers stamped on top. If you have a computer with an Internet connection, you can enter the part numbers in a search engine and find out exactly what each device is. You should be able to identify:

- **Analog-to-Digital Converter (ADC):** When you talk, the pattern of sounds and silence coming out of your mouth is called an *analog* signal: it is continuous, and it can be loud or soft, high-pitched or low-pitched. But most electronic devices are *digital*: they understand only two values, 1 and 0. Therefore, before your cell phone can do anything with the sound of your voice, it must first convert it to a series of 1s and 0s. This is the job of the analog- to-digital converter. It generates a complex code, using only 1s and 0s, that completely encodes all the aspects of your voice. Sound impossible? Think of Morse code. It uses only two values ("dot" and "dash"), yet you can combine those values into an infinite number of complicated messages.
- **Digital-to-Analog Converter (DAC):** This is the partner of the ADC. When you talk to your friend on the phone, her voice arrives at your cell phone as a string of 1s and 0s (thanks to the ADC on her phone). But your ear wouldn't know what to do with that—it's designed to interpret the sounds in a human voice, and a string of 1s and 0s would be gibberish. So your phone has a digital-to-analog converter that converts that string of 1s and 0s back into a human voice, so that your ear can understand it.
- **Digital Signal Processor (DSP):** Once your voice has been turned into digital form, it has to be processed so that it can be transmitted and received properly. Any interference or extra noise has to be removed; it might need to be encrypted; parts of it might need to be amplified. All this processing must be done very, very quickly—otherwise, the person you're talking to will hear pauses in the conversation. The digital signal processor is a very specialized little computer that has been carefully designed to do all this processing in a very short time.
- **Microprocessor:** This is another computer chip. Unlike the digital signal processor, it is not usually very specialized. It doesn't have to be. It handles all the computer work that doesn't need to be done quickly, like storing all the phone numbers you've programmed into your phone and remembering the ring tone you've chosen.

Microphone: A small round device that looks something like a button, the microphone is usually located at the bottom of the phone. When you talk, the microphone picks up your voice and sends it to the analog-to-digital converter on the printed circuit board.

Antenna: Depending on the model of phone you have, the antenna might be easy to spot—a long straight piece, perhaps that can be slid in and out, sticking out from the top of the phone—or it might be a tiny wire built in to the case of the phone itself. In either case, the antenna is where your voice gets sent off into the air, after it has been



converted and processed into a digital signal. The antenna is also where your friend's voice gets picked up so that it can be processed and converted into an analog signal that you can hear.

Speaker: A small, flattish, round or oblong device near the top of the phone. After your friend's voice has been received by the antenna, processed by the digital signal processor, and converted back to an analog human voice by the digital-to-analog converter, the speaker amplifies it so that your ear can hear what she said.

LCD (Liquid Crystal Display): The screen you read your text messages on.

Keyboard: Depending on the type of phone you have, the keyboard might be just a number pad, or it might be a full text keyboard.

Camera: If your phone is a camera phone, see if you can identify the camera. It will be small and round, and tucked into a little hole in the case of the cell phone.

Program Connections

Sparks: Exploring and Experimenting Keeper
Brownies: Key to STEM
Guides: Beyond You: Try New Things; Engineering badge
Pathfinders: Everything Comes from STEM module



String Phones

Use an old-fashioned string phone to help explain sound waves and phones to the girls in this science activity.

Directions

1. Poke a hole in the bottom of each cup.
2. Cut a piece of string about 20 metres long.
3. Thread one end of the string through one cup and tie it onto a paper clip so it won't pull through the hole. Repeat for the second cup.
4. As an extension, test out the designs of different phones. Use paper cups, Styrofoam cups, and plastic cups. Is there a difference in the sound waves created? Which material is better?

Supplies

- ☐ 2 paper cups
- ☐ a sharp pencil or needle to poke holes with
- ☐ fine string or fishing line
- ☐ small paper clips

To use

You and a friend each hold onto a cup and move apart until the string is tight. Make sure that it doesn't touch anything. One person speaks into the cup while the other listens. Can you hear what's being said? Now the other person can try.

Explanation

Speaking into the cup creates sound waves, which change into vibrations at the bottom of the cup. Those vibrations travel along the string and into the bottom of the other cup where they are turned back into sound waves so your friend can hear what you are saying.

Landline phones have microphones that convert the sound waves into electric currents that are sent through the wires, and then converted back into sound waves by the earphone on the other end. Cell phones use radio waves to do the same thing. Radio waves are low energy and low frequency waves from the electromagnetic spectrum.

Program Connections

- Sparks:** Exploring and Experimenting Keeper
Brownies: Key to STEM; Communication is Where It's @ interest badge; SSSS Stands for Sound, Surround, Soothe and Stimulate interest badge
Guides: Beyond You: Try New Things; Engineering badge



E-Cycling

We go through a lot of electronic devices. Many people replace cell phones, laptops, tablets, TVs, gaming consoles and personal music players fairly frequently, and all that electronic waste in landfills is a big problem. The components inside those electronic devices often contain serious pollutants, like lead (Pb); incinerating them releases heavy metals, dioxins and toxic acids into the environment.

So what can a Girl Guide do to help solve the problem? The first step, of course, is not to replace things if you don't have to. Do you really need a new cell phone or a bigger TV? Can you get by with the one you already have, or even with none at all? The less you buy, the less you need to dispose of. Secondly, if your electronics really do need dumping, don't just pitch them into the landfill – recycle them!

For information on electronics recycling in your community, check your local phone book or contact your City Hall/ regional district. You can also try the following resources:

- Electronic Recycling Association (www.era.ca)
- Encorp Return-It! Electronics (www.encorp.ca/electronics)
- Computers for Schools (www.ic.gc.ca/eic/site/cfs-ope.nsf/eng/Home)
- Recycle My Cell (www.recyclemycell.ca)
- Recycling Council of BC (<http://rcbc.bc.ca>)
- The website of the manufacturer of your electronic device; many have some sort of recycling program.

Directions

There are a variety of activities you could do to learn about the need for recycling electronics and how and where to do it in your community. These are suggestions; pick and choose or add your own to plan a meeting that fits your needs.

1. Find out where in your community you can recycle electronics.
2. Learn about how electronics are recycled. Consider taking a field trip to a recycling facility or bringing in a guest speaker. Can you find someone who can break down a computer or other electronic device at your meeting and talk about all the components and how they are recycled?
3. Collect old cell phones and donate them to a charity of your choice (e.g., Red Cross, Canadian Diabetes Association.)
4. Collect old cell phones to raise funds for a Guiding project (e.g., camp maintenance, international trip, etc.) Be sure to follow the guidelines for fundraising and financial management. Check out Cell Cycle www.cellcycle.ca for information.

Supplies

- ☐ community resources information (phone book, computer with an Internet connection, knowledgeable person)

Program Connections

- Sparks:** Going Outside Keeper; In My Community Keeper
Brownies: Key to My Community; Key to the Living World
Guides: You in Guiding: Be Involved in Your Community; Recycling badge
Pathfinders: Our Environment module
Rangers: Environment, Outdoors and Camping (Reduce, Reuse, Recycle)



Hard Drive Maintenance

The hard drive is one of the most critical components in your computer – that's where all your programs, your security software, your school projects, your photos and music are stored. But it needs help to do its job properly. Without regular maintenance, your hard drive will run more slowly than necessary, and it might even crash. Fortunately, there are some simple steps you can take to help keep your hard drive in peak operating condition.

The instructions given here are for computers running Windows 7 and Windows XP. The procedures are very similar for other versions of Windows, but if you need help, try the built-in help for your operating system or look for directions on the Internet.

Directions

Step 1: Clean Up Your Hard Drive

Over time, your hard drive collects all sorts of things you don't really need: temporary files downloaded from the Internet, optional Windows components that you never use, stuff in the recycling bin, and so on. Every so often you should clear out all this junk so that you have plenty of space for the things you do use. Windows provides a Disk Cleanup utility to make it easier.

Supplies

- ☐ a computer running Windows

1. Click the **Start** menu (at the bottom right corner of your screen; in Windows 7 it is the four-colour Windows logo).
2. Click **All Programs**, then **Accessories** and **System Tools**; select **Disk Cleanup**.
3. If you have more than one drive, a dialog box appears so that you can select the one to clean up. The Disk Cleanup utility calculates how much space you can clear up on that drive, and shows a list of files that can be removed.

Note: You can see more options by clicking the **Clean up system files** button. This will let you remove system files and programs that you don't use. However, unless you are absolutely sure what a file or program is for, we recommend that you don't delete it.

4. Select the files you want to remove and click **OK**. You'll see another dialog box asking you to confirm that you really want to delete the files, then the Disk Cleanup utility will go ahead and remove them.

Step 2: Check Your Hard Drive for Errors

As you use your computer, the hard drive can develop bad sectors (parts of the hard drive where data is stored). That slows down the hard drive and makes it harder to save files and retrieve them later. The Error Checking utility (called ScanDisk in earlier versions of Windows) checks the hard drive for errors, bad sectors, and misplaced files. Run this utility fairly often (once a week, if you use your computer every day). It can take quite a while, so choose a time when nobody needs the computer.

1. Close all files and applications.



2. On the desktop, double-click **Computer** or **My Computer** (different computer systems use different words). A dialog box will appear with a list of all the disk drives on your computer. The main one is usually called C:, but there may be others as well.
3. Right-click the drive you want to check for errors and click **Properties** on the pop-up menu.
4. In the **Properties** dialog box, select the **Tools** tab, then click the **Check now...** button in the Error-checking section.
5. In the Check Disk dialog box, select Scan for and attempt recovery of bad sectors.
Note: You should only select Automatically fix file system errors if you already think that your hard drive has bad sectors. If you select this option, you'll be prompted to schedule the Check Disk utility at a time when you can restart your computer.
6. If the Check Disk utility finds any bad sectors, choose to fix them.

Step 3: Defragment Your Hard Drive

When you save documents, pictures, movies or music to your hard drive, you might think that each new file is placed next to the last one on the hard drive, like you would put documents into a filing cabinet. It might start out that way, but it doesn't last. Over time, as files on the hard drive are modified or deleted, blank spaces appear in between them and the hard drive starts splitting new files up and storing the pieces in different locations. This is called fragmentation, and it makes the hard drive work very hard to find all the pieces and put them together again when you want to open the file. Running the Disk Defragmentation utility regularly (once a month is usually appropriate) can help avoid problems. Like the Error Checking utility, Disk Defragmenter can take a long time to run, so choose a time when nobody needs the computer.

1. Close all files and programs.
2. Click the **Start** menu (at the bottom right corner of your screen; in Windows 7 it is a button with the four-colour Windows logo).
3. Click **All Programs**, then **Accessories** and **System Tools**; select **Disk Defragmenter**.
4. In the **Disk Defragmenter** dialog box, select the disk drive you want to defragment, then click **Analyze** or **Analyze disk** (again, different computer systems use different words).
5. The Disk Defragmenter utility will tell you how fragmented your hard drive is. If it is more than 10%, click **Defragment** or **Defragment disk** to fix it.

Step 4: Back Up Your Hard Drive

Even with proper care and maintenance, hard drives can fail. Mechanical components break, storms cause power surges, laptops get knocked off tables, and viruses come from everywhere to infect your computer and render it unusable. When things like this happen, chances are good that you will lose everything stored on your hard drive. If you're okay with that, feel free to skip this step. If not, you must back up your hard drive regularly and often.



How often? For most users, once a week, plus immediately after you make important changes to your computer (for example, after you download 300 summer camp photos from your camera).

Each version of Windows has a slightly different process for backing up the hard drive, and the process for your first backup is different than for subsequent ones. Therefore, we are not going to attempt detailed, step-by-step instructions here. However, the backup utilities are pretty easy to use. The steps given here will get you started, and the utilities themselves will guide you the rest of the way.

1. Decide where you want to store your backup. On the computer itself is not a good place. Use DVDs or an external hard drive. DVDs are cheap, but slow, and very often there is not enough space on one DVD for the entire backup. A better (but more expensive) option is to buy an external hard drive to use just for your backups. They start at around \$100, but they are much faster and easier for backups than DVDs.
2. Start the backup utility:
 - In Windows 7, on the desktop, double-click **Computer**. Right-click the drive you want to back up and click **Properties** on the pop-up menu. Select the **Tools** tab, then click the **Backup now...** button in the Backup section
 - In Windows XP, click the **Start** menu, then **All Programs**, then **Accessories** and **System Tools**; select **Backup**.
 - Follow the prompts to set up a backup and schedule regular backups.
3. When you are asked what you would like to back up, the best option is to let Windows choose and back up everything. That way, the backup will include all your installed software, your preferences, and so on, as well as your personal files. It is much easier to restore your system to the way it was if you have backed up everything.
4. Set a schedule for automatically backing up your hard drive at a convenient time. A backup is only useful if it's recent, so schedule it to run at least once a week—more often if you are doing critical work that you can't afford to lose.

Program Connections

Guides: Computer Skills badge
Pathfinders: Computer Whiz module



Fibre-Optic Water

In many areas, communication networks make use of optical fibres – thin glass "wires", or fibres, that carry information in the form of flashes of light. But how does light travel through the glass fibres? Find out in this experiment.

Directions

1. Take the lid off the jar. With the hammer and nail, carefully punch two holes in the top of the lid: a small one near one side, and a larger one opposite it.
Note: Be careful doing this; ask an adult for help if you need it.
2. Using the duct tape, firmly tape the flashlight to the outside of the bottom of the jar, so that when it is turned on it will shine up through the jar.
3. Cover the rest of the jar with duct tape, leaving just enough room at the top to get the lid back on. You don't want any light to appear through the sides or bottom of the jar.
4. Fill the jar about 2/3 full of water, then turn out the lights in the room.
5. Turn on the flashlight and let the light shine through the open jar onto the ceiling. Notice how it is all "splashy" and disorganized.
6. Put the lid on the jar tightly. Hold the jar over the bowl and carefully tilt the jar so that water runs out of the large hole in the lid in a smooth, steady stream. (The small hole lets air in so that the water can run out smoothly.)
7. Look carefully at the stream of water. Can you see the light inside it? Do you see light spilling out of the stream of water and hitting, say, the wall? Put a finger under the stream. Do you see a tidy dot of light on your finger?

Supplies

- ☐ small glass jar (like a small olive jar, for example) with a metal or plastic lid
- ☐ hammer
- ☐ large nail
- ☐ duct tape
- ☐ small, bright flashlight (e.g., mag light)
- ☐ water
- ☐ large bowl

Explanation

If the water is coming out in a smooth, steady stream, you should be able to see light inside it, but not spilling out all over the place. This is because of an effect called *total internal reflection*: the light would like to escape from the water and go all over, but every time it gets to the boundary between the water and the air, it reflects back into the water. The water-air boundary acts like a mirror that keeps the light trapped inside the stream of water. The light bounces along inside the water until it reaches the end of the stream—where, if you put your finger there, you will see a little, bright dot of light where the light has come out of the water.

Optical fibre works in exactly the same way, except that it is made of glass, not water. Light is sent along the fibre in a series of flashes, or pulses, that carry a coded message—much like you might use a flashlight to send a Morse-code message. A



detector at the other end of the optical fibre detects the pulses of light and decodes the message.

Program Connections

Sparks: Exploring and Experimenting Keeper
Brownies: Key to STEM
Guides: Physics badge; Science badge
Pathfinders: Everything Comes from STEM module



Logical Obstacle Course

Use the principles of some very simple electronic devices in an obstacle course relay race.

Electronic devices are made up of many (thousands, or even millions) of simple devices called logic gates. A logic gate looks at one or more inputs and, depending on whether the inputs are true or false, decides what the output should be. But what do "true" and "false" mean to electronic devices? When you make a decision, you think about all sorts of complex ideas: for example, if you are trying to decide what to have for dinner, your thoughts might run something like this: "I really like macaroni and cheese. Do we have any? Yes, there it is in the back of the fridge. Is there enough? No, there isn't very much, and I'm starving. Is there something else in here that I like? Hmm...pizza. But I had that for lunch, so maybe something different for a change."

Electronic logic gates don't think that way. For them, the only thing to consider is, "Is there an electric voltage on this input?" If a voltage is there, the input is true. If no voltage is there, the input is false. Depending on the type of gate, the conditions on the inputs determine whether the output is true (has a voltage) or false (no voltage).

Mathematically, these conditions are represented as 1 or 0: 1 is true and 0 is false. In this obstacle course game, we'll make it even simpler, using playing cards. A red card is "true", a black one is "false".

This game uses two types of logic gates: an AND gate and an OR gate. (The names are always written in capitals—otherwise, it would be too hard to tell them apart from the regular words "and" and "or" in our language.) Both of our logic gates have two inputs, A and B, and one output.

AND Gate

An AND gate makes the output true (red, in our game) only if *both* the inputs are true. If one of the inputs is false (black), the output is also false (black).

A	B	Output
Black	Black	Black
Red	Black	Black
Black	Red	Black
Red	Red	Red

In a logic diagram or circuit schematic, an AND gate is drawn like this:



OR Gate

An OR gate makes the output true (red) if *either* of the inputs is true. The output is only false (black) if both the inputs are false.

A	B	Output
Black	Black	Black
Red	Black	Red
Black	Red	Red
Red	Red	Red

In a logic diagram or circuit schematic, an OR gate is drawn like this:



Directions

1. Set up your obstacle course. It can be as long or short as you like, but you will need two paths (one for each of two relay teams).
2. Draw an AND gate on one of the sheets of poster board and place it at the beginning of the obstacle course. Draw an OR gate on the other sheet and place it at the end of the obstacle course.
3. Split each deck of cards into two equal stacks. Set two stacks at the beginning of the obstacle course and the other two at the end.
4. Select two girls (or leaders) to be the AND and OR gates. You might want to pin the pictures of the gates onto their shirts, or hang them around their shoulders with a loop of ribbon.
5. Divide the girls into two equal teams, and give each team a stack of cards. Have the teams line up at the beginning of the obstacle course with their stack of cards on the floor in front of them.
6. The first girl in each team takes the top card from her stack and shows it to the AND gate. The AND gate will only let the girls go if they both have red cards. If a girl has a black (false) card, she must take another card from the stack until she gets a red one. When both inputs are red (true), the AND gate says "True!" and lets the girls go through the obstacle course.
7. When the girls get to the end of the obstacle course, they take the top card from the stack at the end and show it to the OR gate. If a girl has a red (true) card, the OR gate says "True!" and lets her run back to her team. If a girl has a black card, she must take another card.

Supplies

- ☐ variety of objects for setting up an obstacle course (hula hoops to spin, beanbags to toss in a bucket, clothes to put on, balls to juggle, etc.)
- ☐ two large sheets of poster board or construction paper
- ☐ large marker
- ☐ two decks of playing cards, well-shuffled



8. When one of the girls arrives back at her team, the next girl in each team picks a card from her stack and the relay continues.

Program Connections

Sparks: Exploring and Experimenting Keeper
Brownies: Key to STEM; Key to Active Living
Guides: Beyond You: Try New Things; Engineering badge
Pathfinders: Everything Comes from STEM module



Computer Programming

Computers might seem smart, but in reality they can only do exactly what they're told. They get instructions from their programs, and if the program is wrong, the computer can't get the job done. When programmers are developing a computer program, they must test and retest it to make sure it does what it's supposed to. Try this activity to see what happens when a program isn't exactly correct. For a simple alternative for Sparks or Brownies, try "Robbie the Robot" instead.

Directions

1. Divide the girls into teams of two or three. Give each team some paper and a pen.
2. Have each team write a program, a set of detailed instructions, for completing a simple task. For example:
 - Tying a shoe
 - Brushing teeth or washing hands
 - Making a peanut-butter-and-banana sandwich
 - Packing gear into a backpack for a hike
3. When the teams have finished writing their instructions, have them trade with another team.
4. Each team reads the instructions they have to a "computer" (one girl or Guider) who must follow the instructions to complete the task. The instructions must be read exactly as written – no additional details or explanations can be given to the computer – and the computer must follow them precisely. If anything is confusing, or if any steps are left out, the computer must proceed as best she can.
5. Did the instructions work? Were any details left out? Could the computer follow the instructions?
6. Give the girls a few minutes to revise their programs. Can the computer do better the second time around?

Supplies

- ☐ paper
- ☐ pens or pencils
- ☐ materials to do the activity described in the program, as required

What else you can do with this

You can easily adapt this activity for girls of different ages and abilities by choosing a task at an appropriate level. The more complex the task, the more challenging this activity. You can also increase the challenge level by setting a time limit for writing the program.

Program Connections

- Brownies:** Key to STEM; Communication is Where It's @ interest badge
Guides: You and Others: Build Skills in Communication; Computer Skills badge
Pathfinders: Everything Comes from STEM module



Write a Program from Scratch

Scratch is a programming language that lets you create interactive stories, animations, games, music and art. It's a fun way to learn some basic programming concepts, and it helps you learn to think creatively, reason systematically and work collaboratively.

Scratch is a free software program developed by MIT that you can download from the Internet. To learn all about it, go to the Scratch website (<http://scratch.mit.edu>). There are lots of examples of projects people have created using Scratch, and lots of help for you to get started.

When you go to the download page (<http://scratch.mit.edu/download>), there is a form asking for all sorts of information; you do not have to fill in any of it to download the software. Just scroll down to the bottom of the page and click the **Continue to Scratch download** button.

Directions

1. If you haven't already done so, download Scratch software (<http://scratch.mit.edu/download>) and install it on your computer.

Note: Check with your parents before you do this. Scratch is a well-known, non-malicious program, but it is always a good idea to make sure your parents are okay with anything you want to download.

Supplies

- ☐ a computer with an Internet connection

2. Follow the instructions in the Getting Started guide (http://info.scratch.mit.edu/Support/Get_Started) to create your first simple project: making a cat dance on your screen.

Note: The Scratch software and website give you the option of creating an account and sharing your projects with other Scratch programmers. If you want to do this, and if your parents are okay with it, go ahead. But it is optional: if you would rather not sign up for an account and share your projects, you don't have to.

3. Once you have the hang of programming with Scratch, make your own creative animation project. The Scratch website has lots of resources to help you out. For a good place to start, check out the Scratch Reference Guide on the Support page (<http://info.scratch.mit.edu/Support>)

What else you can do with this

If several girls in your unit are interested in creating their own projects, plan a Scratch Movie night. Each girl who wants to create a short animation project, burns it onto a DVD and brings it in to the meeting. Make popcorn and watch all the Scratch movies (use a TV/DVD player or laptop, or try to borrow an LCD projector). If you want, nominate the best movies for your very own Scratch Oscar awards.

Program Connections

Brownies: Key to STEM

Guides: Beyond You: Try New Things; Art Production badge; Computer Skills badge

Pathfinders: Movie Mania, The Arts from A to Z, Computer Whiz modules

Rangers: Explore Your Creativity



Robot Pin the Tail on the Donkey

Robots are used in many, many different places. They work in factories to assemble cars; they travel to outer space to explore other planets and asteroids; they diffuse bombs in dangerous areas; and they search disaster zones for survivors. The really amazing part, though, is that robots do all these things without being able to think for themselves. Robots, like computers, can only do what they are told.

This activity is a variation on "Pin the Tail on the Donkey". Instead of groping your way toward a picture of a donkey to pin a tail on it, direct your "robot" friend to do the job for you.

Directions

1. Blindfold your partner and give her the donkey's tail.
2. Give her directions to navigate around the room and stick the tail on the donkey, e.g., "Take ten steps forward" or "Turn right". Your "robot" must follow the instructions exactly, and she cannot ask questions to confirm or clarify your meaning. How easy or hard is it to get her to the destination?
Note: You can adjust the challenge of this activity by making the path to the donkey very simple, or very complex with obstacles that must be avoided.
3. Switch roles with your partner.
4. Once you've both had a chance to be the robot and the controller, think of what was hard about this activity. For example:
 - Were there any situations where you had to stop the robot to keep her from running into obstacles? What caused those situations?
 - Did your robot ever misunderstand your instructions? Why?
 - Did you give any instructions that you thought were clear, only to have your robot interpret them in a different way than you meant? For example, perhaps you said "Go right ten steps", expecting her to turn to the right and walk ten steps, but she stepped sideways to the right ten times.
5. Think of ways to make it easier to control the robot and make her do exactly what you need her to do. Try pinning the tail on the donkey again, using your improved method of controlling the robot.

Supplies

- ☐ partner
- ☐ blindfold
- ☐ large picture of a tail-less donkey
- ☐ donkey tail (strip of paper or a piece of ribbon)
- ☐ tape or pin

What else you can do with this

In real life, robots often have some sort of feedback system: they can send information back to the controller. For example, a robot might send back information about its bearing (the direction it's headed) and speed; or it might have a video link that lets the controller see what is around the robot. To experiment with this idea, draw a diagram showing the route you want your robot to take through all the obstacles to the donkey. Remove the robot's blindfold and turn your back so that you cannot see her. Using your diagram, give her instructions to get her to the donkey. After each instruction, she



should give you some basic feedback, such as "I am facing the door" or "I am beside a desk". Does this make it easier or harder to get your robot to the donkey?

Program Connections

Sparks: Exploring and Experimenting Keeper

Brownies: Key to STEM

Guides: You and Others: Build Skills in Communication; Engineering badge

Pathfinders: We're a Team!; Everything Comes from STEM



Training your Robot

In this game, one girl writes a “program” for another girl to make her way through an obstacle course.

Directions

1. Set up an obstacle course in the room using available equipment – benches, masking tape, nets, pool noodles, etc.
2. Divide the group into pairs. One is the “robot”, and the other is the “programmer”.
3. The programmer writes a program for the robot to follow using only the words from the Robot Dictionary.
4. Take the “robots” away to do another activity until the programmers have finished writing their program (or have all girls be programmers and write programs, then exchange programs with their partner, and all become robots).
5. When the program is complete, the “robot” takes it and follows the directions.
6. The goal is for the “robot” to go from the start, through the course, pick up the ball, back through the course, and end with dropping the ball in the garbage can.
7. Debrief: how did your program work? Are there words you would like to add to the robot dictionary?

Supplies

- ☐ items to create an obstacle course, e.g. pool noodles, masking tape, ball, garbage can, etc.
- ☐ paper and pencil

Robot Dictionary

step	forward	backward
turn	rotate	right
left	grab	drop
up	down	reach

numbers (1-9)

Program Connections

Sparks: Exploring and Experimenting Keeper
Brownies: Key to STEM; Key to Active Living
Guides: You and Others: Build Skills in Communication; Engineering badge
Pathfinders: Everything Comes from STEM



Robbie the Robot

This is a simple activity that is an alternate activity to “Computer Programming” and would be suitable for Sparks or Brownies. It will help the girls understand how directions need to be simple, clear and concise when programming a robot to move.

Directions

1. Place your blocks on the table.
2. Explain to the girls that they are going to tell Robbie what to do and how to move so that she can build a tower. Also explain that Robbie can only do what she's been told to do, and nothing more. Also, Robbie doesn't understand complex directions (more than one thing at a time)
3. One leader plays Robbie Robot.
 - Her job is to follow directions from the girls to the letter.
 - If she can't follow that direction, then she can indicate that she is confused only by shrugging her shoulders.
 - She cannot do something that she has not been instructed to do.
4. Pick one girl to start.
 - Directions should be simple like “move your hand 3 inches to the left”. “Put your hand on top of the block to the left of your hand.” “Grasp the block”
If she tells Robbie to “Pick up a block”, but because she hasn't said which block or where, Robbie will show that she is confused by shrugging her shoulders.
5. At this point, if the girl confuses Robbie, the job of instructing passes on to the next girl.
6. The activity continues until Robbie has built the tower.
7. At the end of the activity, talk about which directions were easy for the robot to understand and which ones were difficult.
8. You can try this activity again, but try instructing your robot to make a peanut butter and jelly sandwich or tie a shoe. Any simple activity will work.

Supplies

- ☐ Lego blocks or wooden blocks or boxes or something that can be used to build a tower
- ☐ table

Program Connections

Sparks: Exploring and Experimenting Keeper
Brownies: Key to STEM; Communication is Where It's @ interest badge



Global Positioning System

The Global Positioning System is a form of technology that has integrated into our lives. Learn about how the Global Positioning System works, then (optional) try the BC Geocaching challenge (<http://bc-girlguides.org> select Program > Challenges & Activities > Provincial Challenges to find the requirements).

For Guides and older, this animated video explains how GPS works:

<http://www.brainpop.co.uk/humanities/geographymapsatlasesandglobes/globalpositioningsystem/>

For Pathfinders and Rangers, check out these videos:

Case of the Technical Knockout – How Does GPS Work: <http://youtu.be/3zRlbboMvb0>

How does GPS work?: <http://youtu.be/vfzAL5L29Y>

If your meeting place does not have an Internet connection, you can download videos to playback while not online. See <http://www.wikihow.com/Download-YouTube-Videos> for instructions.

How does a GPS receiver work?

The GPS receiver does not send any signals – it only receives them. There are about 30 satellites in the sky, of which 24 transmit signals. They send out their location and the current time.

The GPS receiver needs to “see” at least 3 or more satellites to figure out where it is. It then figures out how far away each receiver is based on how long it took for the signal to reach it. The GPS receiver can figure out spheres which show how far away the satellites are. The intersecting point of the spheres will determine where you are. This is called “trilateration.”

The system was first launched in the 1970s. In 1983 a civilian airplane was shot down when it got lost over Soviet territory, so it was decided that the system needed to be available for civilian use. In the 1990s it was fully operational and the first commercial GPS units were available. But there was “selective availability” built into the signals – noise – so that the technology could not be used against the US department of defense. Accuracy was about 100 m.

On May 1, 2000 Bill Clinton decided to turn off Selective Availability, improving accuracy to 20 m.

What is GPS used for?

Originally used for military positioning, navigation, and weapons aiming system

Five categories of use:

1. Location – measure volcanoes & glaciers, growth of mountains, location of icebergs, location where you have been.
2. Navigation – gets you from one place to another place on water, air or land.
3. Timing – brings precise time to all because there are atomic clocks on the satellites and this information is delivered to the GPS receivers.



4. Mapping – create maps by recording a series of locations.
5. Tracking – can track packages, or even people, if they have a GPS receiver and transmitter on them.

Some other uses: precision farming, open pit mining, oil exploration, airport/harbor approaches, animal migration and population study, construction, emergency services (find best route), aiding the blind and more!

Some Types of GPS Receivers

- Car – navigation and traffic alerts, includes Bluetooth for phone connection
- Handheld – for outdoors use – replaces map & compass
- Sports/fitness – for cycling or running – route mapping, heart rate, cadence data, cycle computer
- Marine – built with details coastal information, allowing marine navigation and course plotting
- Aviation – maps, terrain, route info, airport info, etc.

Directions for Sparks & Brownies

This simple game illustrates how to use a GPS receiver to find a geocache.

1. Before the meeting, hide the containers in various locations around the meeting place. Best if they aren't in the same room!
2. Give each Guider instructions to her geocache (or to all the geocaches, but set an order to find them in so no two groups are searching for the same thing at the same time).
3. Split the girls into groups. Best to have as many girls in each group as there are geocache containers so each girl gets a turn to be the navigator. Note that we had five geocaches, so we were able to have five girls per group.
4. Each group has a GPS Guider. The GPS Guider cannot talk, she can only beep. She represents the GPS receiver that is receiving signals from the satellites in the sky.
5. For each geocache the girls hunt for, a different girl is the navigator. The navigator holds her hand out in front of her and points. If she is pointing in the direction of the geocache, the GPS Guider will beep. Softly and slowly if she is far away from the cache, louder and faster as she gets closer to the geocache. If the girl veers off course, the GPS Guider will stop beeping.
6. The navigator will need to turn in a circle with her hand pointed in front of her in order to determine which way to go.
7. Before moving on to the next cache, either meet at a central meeting spot with all groups, or wait to make sure the next group has found their cache before moving on.

Supplies

- ☐ Several different types of geocaching containers. For example: a magnetic key holder, a small bison tube, a small lock n lock container, a waterproof match container, and a larger box.
- ☐ Supplies for inside the containers - [log sheets](#), pencils, trade items (any dollar store trinkets will do as a demonstration), [trackables](#) (if you have access to them).

**Directions for Guides and older****Part 1: Measuring Distance with Time**

A GPS Receiver calculates how far away the satellites are by looking at the time signal sent by the satellite and comparing it with the current time. It knows the speed that the signal travels at, so it can calculate the distance.

Supplies

- ☐ stopwatch
- ☐ blindfold (optional)

1. This activity requires 5 girls. You can either use the 5 girls to demonstrate this concept to the group, or use this activity in a round-robin. Assign each girl a different role. You need a “satellite,” a “signal,” a “timer” and two “geocaches.”
2. In a large open area, have the satellite and the signal stand together. The satellite needs to close her eyes (or have a blindfold on) because satellites don’t “see” – they only send out signals.
3. Have the two geocaches stand away from the satellite at different locations – not on the same path from the satellite, and not at the same distance.
4. On “go” the timer begins timing and the signal walks towards one of the geocaches. When the signal reaches the geocache, she calls out STOP and the timer stops timing and calls out the time it took to get to the geocache.
5. “Reset” the signal by sending her back to the satellite (who still can not see). Now on “go” have the signal walk towards the second geocache (important: she MUST walk at the same speed), again calling out STOP when she arrives.
6. Read out the two times. Can the satellite guess which geocache is farther away?
7. Explain: when you are driving on the highway, you can see your speed in kilometers per hour (kph or km/hr), or distance divided by time. If you know how fast you are moving and you know the amount of time you are moving, then you can figure out the distance traveled using math. (distance = speed x time). The GPS receiver knows how fast the signal from the satellite moves at, and knows how much time it took to get there, so it can calculate the distance.

Part 2: Tri-it!

Trilateration is when you use the geometry of circles or spheres to determine a location. GPS receivers use spheres in 3-D trilateration calculations. This activity uses circles in 2-D trilateration (2 dimensional because we are on the surface of the Earth, and not in the sky, like a satellite).

Supplies

1. You will need to set this activity up in advance. Choose a large open area where you can use chalk on the ground. (Alternately, if you can’t use chalk, you can use string to mark your circles.) Start by placing a temporary marker in the location that the girls are to find. This is like marking a “waypoint” on the GPS receiver.

- ☐ temporary markers (masking tape, Frisbees, traffic cones, etc.)
- ☐ three pieces of rope of varying lengths – between 3 and 8 m long)
- ☐ 3 pieces of sidewalk chalk



2. Lay out three ropes in straight lines, starting from the waypoint and extending out in different directions.
3. At the end of each rope, place a marker (i.e. masking tape, Frisbee, traffic cone, etc.) then coil each rope up and place each at it's marker. Remove the temporary waypoint marker.
4. This activity requires 6 girls. You can either use the 6 girls to demonstrate this concept to the group, or use this activity in a round-robin. Assign 3 girls to be "satellites" and 3 girls to be "signals".
5. The satellites stand at the marked locations and hold on to one end of the rope. Don't drop it!
6. One at a time, the signals pick up the other end of the rope and extend it to its full length. They then walk around the satellite in a circle, with the rope taut at all times, and draw a circle on the ground with the chalk. Each circle represents how far away you are from a satellite. When one circle is drawn (i.e. if you can only "see" on satellite), your waypoint could be anywhere on that circle.
7. When two circles are drawn, unless you set the locations up 180 degrees away from each other (i.e. in a straight line) you should have two points that the circles intersect. This means your waypoint could be at either of the two intersections.
8. Finally, when the third circle is drawn, you will find that this is only one place that all three circles intersect. If your measurements are accurate, this intersection will be at a single point, but if there are some errors in distance (which is quite possible when using girls, ropes and chalk!) you will have a small triangle which your original waypoint was within.
9. Discuss: Why do you need three satellites for GPS to work? What would happen if you had signals from more satellites?

Program Connections

Sparks:	Exploring and Experimenting Keeper
Brownies:	Key to STEM; Which Way interest badge; Happy Hiking interest badge
Guides:	Engineering badge; Hiking badge
Pathfinders:	Finding Your Way; Everything Comes from STEM modules



Pixel Picture

Today, not many people use film cameras. Digital cameras, cell phones and tablets with cameras on them are everywhere! When light goes through the lens of the camera it lands on a sensor inside the camera. The sensor is divided up into millions of small squares, which are called pixels. Depending on the brightness and the colour of light landing on each pixel, the sensor sends out a different electrical charge. The computer inside the camera converts the electrical charge readings into a picture. A 1 MP (megapixel) camera has 1 million tiny squares; a 14 MP camera has 14 million squares! The more pixels a camera has, the more detailed the image will be.

Directions

1. Explain how a digital camera works by reading aloud the paragraph above.
2. Tell the girls that they are going to draw a pixel picture that has a resolution of 676 pixels (26x26). This is far less than a digital camera, but gives an idea of how the camera works.
3. Have the girls work through the instructions on the Pixel Picture Grid.
4. Optional: Draw your own pixel picture on a blank grid and translate it into instructions for another girl to follow to recreate the picture.

Supplies

- ☐ a copy of the Picture Pixel Grid for each girl
- ☐ pencil or marker for each girl

What else you can do with this:

Find more pixel pictures (Pic-a-Pix) online, including both black & white or colour pictures, at: <http://www.conceptispuzzles.com/index.aspx?uri=puzzle/pic-a-pix>.

Program Connections

- Sparks:** Exploring and Experimenting Keeper
Brownies: Key to STEM, All About Art interest badge
Guides: Art Production badge, Engineering badge, Picture This badge
Pathfinders: Everything Comes from STEM module, Camera Crazy module, The Arts from A to Z module



Pixel Picture Grid

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1																										
2																										
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22																										
23																										
24																										
25																										
26																										

Fill in the following squares to reveal the picture that the sensor has saved to the digital camera's computer.

Row 1: I, O

Row 2: I, J, N, O

Row 3: I across to O

Row 4: H across to P

Row 5: H across to P

Row 6: I across to O

Row 7: J across to N

Row 8: I across to O

Row 9: I across to O

Row 10: H across to P

Row 11: H across to P

Row 12: G across to Q

Row 13: G across to Q

Row 14: G across to Q

Row 15: G across to Q

Row 16: H across to P

Row 17: H across to P

Row 18: A across to Z

Row 19: A across to K; M, N;
P across to Z

Row 20: M, N

Row 21: M, N

Row 22: M

Row 23: L, M

Row 24: L

Row 25: L

Row 26: L, M



Internet Packet Relay

The Internet has just one job – to move information (known as data) from one place to another place. Just like the postal system, every computer has a unique numeric address (which are called IP – Internet Protocol – addresses). When you want to look at a website on the Internet, for example, your computer sends out a request to the website's IP address (for example, if you type in bc-girlguides.org into your web browser, the computer converts this into the IP address for the website, which is 69.77.165.33). The request travels from your computer (which also has its own IP address), to other computers, called “routers,” which direct the request to the correct computer on the network. When the request reaches its destination, the other computer sends information back to your computer in what are called “packets” – small amounts of data. Each packet of data may take a different route to your computer – whichever way is fastest at the moment – then your computer reassembles the information. It is just like splitting the information up like a jigsaw puzzle and reassembling the puzzle at your home. Except that the data travels incredibly quickly, so you don't even notice that it is coming to you in packets!

If your meeting place does not have an Internet connection, you can download videos to playback while not online. See <http://www.wikihow.com/Download-YouTube-Videos> for instructions. Or you can use smartphones that have data plans to watch the videos.

If possible, watch “There and Back Again: A Packet's Tale – How Does the Internet Work?” <http://youtu.be/WwyJGzZmBe8>

Directions

1. Split the girls into teams of about 6 girls each. You will need one puzzle per team. You can either use a simple child's puzzle, or cut a picture into several pieces to make your own puzzle.
2. Set the room up so that that the puzzles are on one table at one end of the room. Place a pair of dice with each puzzle. This is the “puzzle server”.
3. Set up a six “routers” around the room and label them – for example Router 1, Router 2, Router 3, etc. Distribute the routers around the room and connect them either with rope placed on the floor, a line of chalk drawn between them, or with masking tape (before applying masking tape to the floor, ensure that this is allowed in your meeting space). Connect the puzzle table to one or more routers, and connect each starting location to a router. A sample setup is shown on the next page.
4. The girls line up at their starting locations (their home computers), on the opposite side of the room from the puzzles.
5. On “go” the first girl in each team follows the network (lines between the routers) to make her way to the puzzle table.

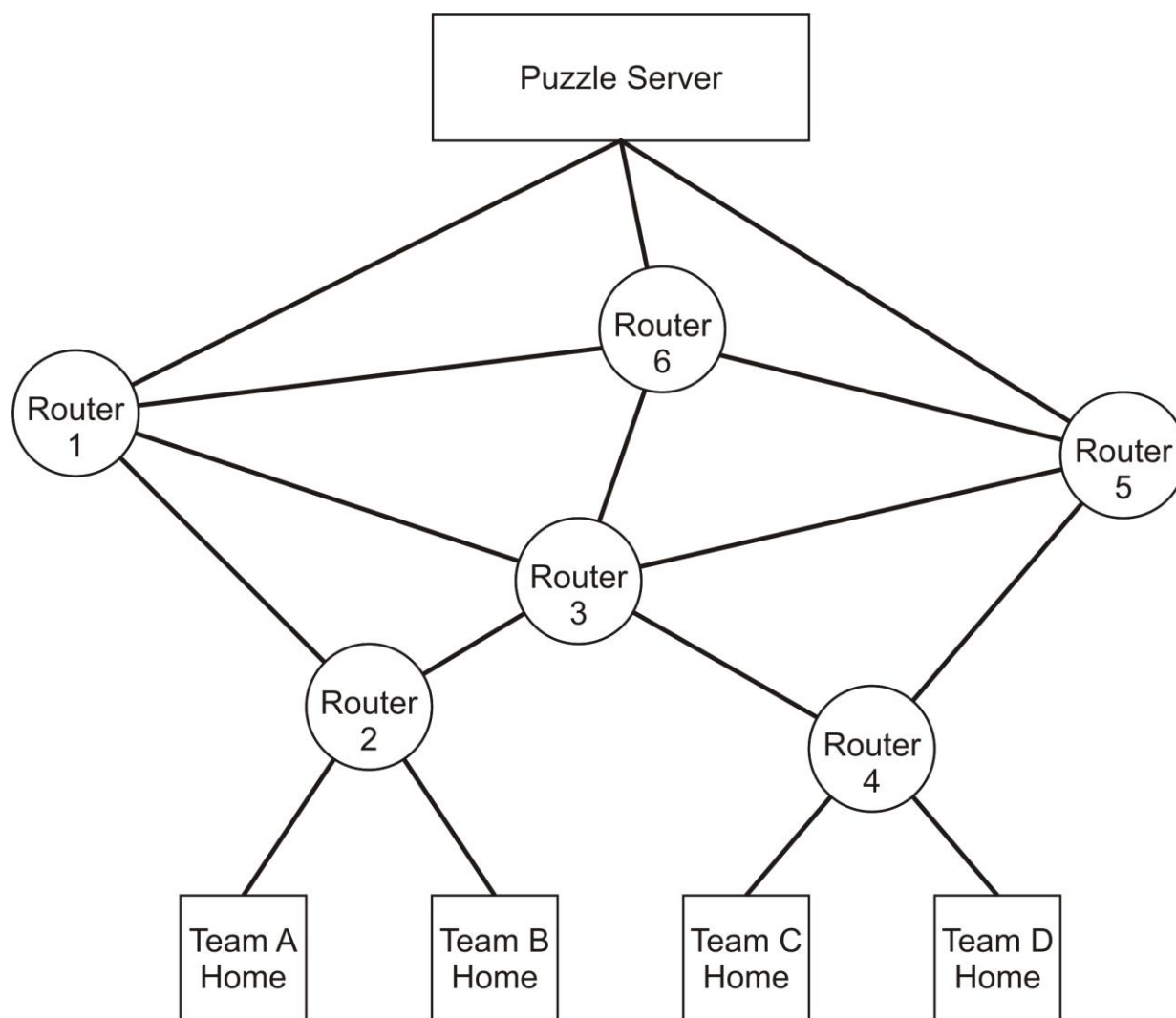
Supplies

- ☐ a puzzle for each team
- ☐ a pair of dice for each team
- ☐ something to represent routers (i.e. chairs)
- ☐ signs for 6 routers (Router 1, Router 2, etc.)
- ☐ something to mark the network (i.e. rope, chalk masking tape)



6. At the puzzle table, she picks up one piece of the puzzle and rolls the dice. The numbers on the dice indicate which routers she must go through to travel back to her home computer. She can take any route she would like, but must touch both routers indicated by the dice. If she gets doubles, she only needs to go through one router to return to her computer. However, she may have to go through more routers, depending on your setup.
7. When a puzzle piece has arrived at the home computer, the next girl in line repeats the process. The remaining girls can assemble the puzzle as they wait for their turn.
8. Continue until all puzzle pieces have been received and the puzzle has been assembled.

Sample Room Setup



Program Connections

- Sparks:** Exploring and Experimenting Keeper
- Brownies:** Key to STEM; Information Technology is “IT” interest badge; Team Together interest badge
- Guides:** Computer Skills badge; Engineering badge
- Pathfinders:** Everything Comes from STEM module; Web Surfin’ module



PROGRAM CONNECTIONS

The following index lists the pages to activities where you will find reference to program connections within this document. Please see individual activities for more detailed connections.

Sparks

Exploring and Experimenting Keeper, 5 (Cyber-Safety: CyberSense Poem), 9 (Be a Computer!), 12 (Build a Computer (for Junior Techies), 13 (Computer Jeopardy), 21 (Computer Concentration), 24 (Cell Phone Relay), 26 (Dissect a Cell Phone), 29 (String Phones), 34 (Fibre-Optic Water), 36 (Logical Obstacle Course), 41 (Robot Pin the Tail on the Donkey), 43 (Training your Robot), 44 (Robbie the Robot), 45 (Global Positioning System), 49 (Pixel Picture), 51 (Internet Packet Relay)

Going Outside Keeper, 30 (E-Cycling)

In My Community Keeper, 30 (E-Cycling)

Brownies

Key to Active Living, 19 (Squeaky Clean), 24 (Cell Phone Relay), 36 (Logical Obstacle Course), 43 (Training your Robot)

Key to My Community, 30 (E-Cycling)

Key to STEM, 5 (Cyber-Safety: CyberSense Poem), 9 (Be a Computer!), 12 (Build a Computer (for Junior Techies), 13 (Computer Jeopardy), 21 (Computer Concentration), 24 (Cell Phone Relay), 26 (Dissect a Cell Phone), 29 (String Phones), 34 (Fibre-Optic Water), 36 (Logical Obstacle Course), 39 (Computer Programming), 40 (Write a Program from Scratch), 41 (Robot Pin the Tail on the Donkey), 43 (Training your Robot), 44 (Robbie the Robot), 45 (Global Positioning System), 49 (Pixel Picture), 51 (Internet Packet Relay)

Key to the Arts, 9 (Be a Computer!)

Key to the Living World, 30 (E-Cycling)

Brownie Interest Badges

All About Art, 49 (Pixel Picture)

Communication is Where It's @, 24 (Cell Phone Relay), 29 (String Phones), 39 (Computer Programming), 44 (Robbie the Robot)

Happy Hiking, 45 (Global Positioning System)

Information Technology is "IT", 5 (Cyber-Safety: CyberSense Poem), 19 (Squeaky Clean), 51 (Internet Packet Relay)

SSSS Stands for Sound, Surround, Soothe and Stimulate, 29 (String Phones)

Super Crafts, 12 (Build a Computer (for Junior Techies)

Team Together, 51 (Internet Packet Relay)

Which Way, 45 (Global Positioning System)

Guides

Beyond You: Try New Things, 26 (Dissect a Cell Phone), 29 (String Phones), 36 (Logical Obstacle Course), 40 (Write a Program from Scratch)

You in Guiding: Be Involved in Your Community, 30 (E-Cycling)

You and Others: Build Skills in Communication, 39 (Computer Programming), 41 (Robot Pin the Tail on the Donkey), 43 (Training your Robot)

Guide Interest Badges

Art Production, 40 (Write a Program from Scratch), 49 (Pixel Picture)

Computer Skills, 6 (Cyber-Safety: Jo Cool and Jo Fool), 8 (Social Media Awareness), 9 (Be a Computer!), 13 (Computer Jeopardy), 19 (Squeaky Clean), 21 (Computer Concentration), 31 (Hard Drive Maintenance), 39 (Computer Programming), 40 (Write a Program from Scratch), 51 (Internet Packet Relay)

Engineering, 24 (Cell Phone Relay), 26 (Dissect a Cell Phone), 29 (String Phones), 36 (Logical Obstacle Course), 41 (Robot Pin the Tail on the Donkey), 43 (Training your Robot), 45 (Global Positioning System), 49 (Pixel Picture), 51 (Internet Packet Relay)



Hiking, 45 (Global Positioning System)

Physics, 34 (Fibre-Optic Water)

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Recycling, 30 (E-Cycling)

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Pathfinders

Camera Crazy, 49

Computer Whiz, 9 (Be a Computer!), 13 (Computer Jeopardy), 19 (Squeaky Clean), 21 (Computer Concentration), 31 (Hard Drive Maintenance), 40 (Write a Program from Scratch)

Everything Comes from STEM, 24 (Cell Phone Relay), 26 (Dissect a Cell Phone), 34 (Fibre-Optic Water), 36 (Logical Obstacle Course), 39 (Computer Programming), 41 (Robot Pin the Tail on the Donkey), 43 (Training your Robot), 45 (Global Positioning System), 49 (Pixel Picture), 51 (Internet Packet Relay)

Finding Your Way, 45 (Global Positioning System)

Movie Mania, 40 (Write a Program from Scratch)

Our Environment, 30 (E-Cycling)

The Arts from A to Z, 40 (Write a Program from Scratch), 49 (Pixel Picture)

Web Surfin', 6 (Cyber-Safety: Jo Cool and Jo Fool), 7 (Cyber-Safety: In the Eye of the Beholder), 8 (Social Media Awareness), 51 (Internet Packet Relay)

We're a Team!, 41 (Robot Pin the Tail on the Donkey)

Rangers

Community Connections, 7 (Cyber-Safety: In the Eye of the Beholder), 8 (Social Media Awareness), 13 (Computer Jeopardy), 19 (Squeaky Clean), 21 (Computer Concentration)

Environment, Outdoors and Camping, 30 (E-Cycling)

Global Awareness, 7 (Cyber-Safety: In the Eye of the Beholder), 8 (Social Media Awareness)